

## INTELLIGENT META PACS SYSTEM AND SERVER

### 1 CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. provisional patent application Ser. No. 62/981,280, filed on Feb. 25, 2020, entitled Intelligent Meta PACS System and Server, which is incorporated by reference herein in its entirety.

### 2 FIELD OF INVENTION

[0002] The present invention relates to a system and server that improves the coordination, operability, and functionality of an existing Picture Archiving and Communication System (PACS) and its server. The present invention is a specific implementation of the “System for Process Coordination and Interoperability across Different Systems, Platforms and/or Businesses” disclosed in pending patent application Ser. No. 16/037,249 filed on Jul. 17, 2018, which is incorporated by reference herein in its entirety. In particular, this application is an implementation related to medical records in the medical field utilizing the Digital Imaging and Communications in Medicine (DICOM) standard and PACS server.

### 3 BACKGROUND OF THE INVENTION

#### 3.1 the Digital Imaging and Communications in Medicine (DICOM) Standard

[0003] The Digital Imaging and Communications in Medicine (“DICOM”) standard is one that was created as a universal framework to deal with all functional aspects of digital medical imaging. The DICOM standard traces its roots back to 1985 when the American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) collaborated to publish the ACR-NEMA Standards Publication No. 300-1985 which laid out a standard method for the transmission of digital medical images and their associated information. The promise of standardization in medical images was not achieved until ACR-NEMA published Version 3 of their standards in 1993 renaming the same to DICOM.

[0004] The DICOM standard governs the practical use of digital images in medicine. It deals with image storage, data transfer and image display. As such, DICOM does all of the following:

[0005] it specifies a network protocol for image transmission using TCP/IP.

[0006] it defines the structure for image objects and their associated information as well as creating a mechanism for uniquely identifying such objects when they are acted upon over the network.

[0007] it sets up information groupings for patients, studies, series and other data so as to permit logical organization of the data.

[0008] A full explanation of DICOM can be obtained at: <http://dicom.nema.org/dicom/geninfo/Strategy.pdf>.

#### 3.2 The Picture Archiving and Communication System (PACS)

[0009] The actual implementation of DICOM-based imaging within a medical provider is provided by a Picture Archiving and Communication System (PACS). The PACS

is a medical system consisting of all the necessary technology hardware and software to enable the acquisition, storage, retrieval, transmission and display of digital medical images. Put differently, the PACS enables the digital imaging workflow within a provider.

[0010] The basic components of a PACS are:

[0011] DICOM-aware image acquisition devices or modalities that actually obtain the medical images and convert them into DICOM format.

[0012] The PACS server which is the computing brain of the PACS. The PACS server provides the short and long-term storage of DICOM images obtained by the modalities. It also manages these images, permits their retrieval and distribution, and makes them available for presentation.

[0013] DICOM-capable workstations which provide interactive display of digital images from the PACS server using software that understands the DICOM formats.

[0014] FIG. 1 shows an example of how a prior art DICOM-based PACS 100 is configured within a medical facility. In the rest of the description below, the terms PACS or PACS system are used to refer to a PACS server 110, while specifically referring to the other PACS elements as modalities  $M_n$  or workstations  $WS_n$ . When the term PACS is used to reflect the full PACS 100 as described above, it will generally explicitly indicate as such, though in most such cases the meaning should be obvious from the context.

[0015] As shown in FIG. 1, a PACS server 110 interconnects various modalities  $M_n$  and workstations  $WS_n$  in a medical facility. A department of a medical facility has various modalities  $M_n$ . The Radiology department may have five modalities—Computed Radiography (CR)  $M_1$ , Digital Radiography (DX)  $M_2$ , Computed Tomography (CT)  $M_3$ , Magnetic Resonance (MR)  $M_4$ , and Mammography (MG)  $M_5$ . The Cardiology department may have 3 modalities—X-Ray Angiography (XA)  $M_6$ , Ultrasound (US)  $M_7$ , and Electrocardiography ECG ( $M_8$ ). The Ophthalmology department may have 3 modalities—External-camera Photography (XC)  $M_9$ , Ophthalmic Photography (OP)  $M_{10}$ , and Secondary Capture Device (SC)  $M_{11}$ . The Dermatology and other departments may have 5 modalities—External-camera Photography (XC)  $M_{12}$ , Other Device (OT)  $M_{13}$ , Secondary Capture Device (SC)  $M_{14}$ , SR Document Unit (SR)  $M_{15}$ , Portable Document Format Scanner (PDF)  $M_{16}$ .

[0016] A medical facility also has various workstations  $WS_n$ , such as a Workstation  $WS_1$  at a nurse station, a personal computer  $WS_2$  of a doctor, a laptop  $WS_3$  of a radiologist, and a Tablet/Mobile device  $WS_4$  of a therapist.

[0017] The existence of a PACS server 110 in conjunction with modalities  $M_n$  and workstations  $W_n$  that all operated with the DICOM standard created remarkable efficiency in the handling of medical images within a medical provider. Prior to DICOM's establishment, providers had to contend either with physical film or with a variety of incompatible digital imaging formats that could not be used across the provider easily, let alone shared with outside facilities. With a PACS server 110 and DICOM-aware modalities  $M_n$ , providers were able to create a straightforward workflow that permitted efficient use and transfer of medical images. For example, a PACS server 110 with DICOM-aware modalities  $M_n$  made the following workflow possible, as shown in FIG. 2: